

Exploration “Thinking” and the Present State of Machine Learning Workflows

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Summary

Computational enhancements to exploration thinking have been included in our workflows from the beginning; ever since William Smith made detailed stratigraphic measurements in Great Britain in 1815 and Conrad Schlumberger began conducting electrical measurements in 1916. Geoscientists have always used analytical means to evaluate the subsurface and to create maps designed to extrapolate various surfaces between points of control. The first radical change in mapping methodology came with the advent of mainframe, then SPARC workstations. With the computers various mapping algorithms began to be deployed to generate contour and grid files. The increase in computing power of silicon chips and the reduction in cost led to the movement to the PC platform and better integrated software packages however the core functionality of the contouring and gridding algorithms, while improved, were basically the same as they had been decades earlier.

Today we see the inclusion of a new step change, that of machine learning methods (MLM), or computing techniques that give computers the ability to “learn” without explicit programming instructions. There are two broad classes of MLM, those of Supervised Learning involving classification and regression analysis, and Unsupervised Learning which focusses on Cluster and/or Principle Component Analysis. Both MLMs have strengths and weaknesses and both methods are being broadly and effectively deployed in field development. However, the inherent weaknesses of MLM create difficulties when applied to the exploration workflow and care must be taken to use MLM differently in the exploration process than in the development workflow.

The fundamental differences between the Exploration Process and the Field Development Workflow, both with and without the assistance of MLM, will be examined and the proper role and guidelines for MLM for each will be discussed.

Theory / Method / Workflow

Exploration and Development Geoscience Workflows have fundamental differences and objectives some which play to the strengths of the machine and some which play to the strengths of the human mind. It is important to understand both the objectives and methods of human and machine workflows in order to obtain optimum performance.



Results, Observations, Conclusions

MLM have already demonstrated their usefulness in oilfield operations and the use of MLM will be increasing as more resources are deployed in understanding how best to train and utilize this tool. However, MLM are not a panacea to ever increasing efficiency gains and the primary applications today are found in field development projects rather than in exploration.